

**Remarks**

This Amendment is submitted in response to the outstanding Office Action wherein the Examiner rejected Claims 1-22, all the claims under consideration. Reconsideration and allowance of the application in view of the amendments submitted herewith and the following remarks is respectfully requested.

Prior to discussing the prior art rejections, Applicants take this opportunity to set forth the following brief remarks about their invention. Applicants have discovered a method for forming a splined shaft in which the advantages of aluminum alloys tempered to a T4 condition may be appreciated without experiencing the disadvantageous effects of the instability in T4 tempered alloys.

More specifically, a T4 temper aluminum alloy material is desirable from a ductility and strength standpoint for use in stamping operations. One such advantage is that it does not need to be solution annealed in order to be able to approach stronger T6 temper properties in the finished components. The T4 temper materials need only be aged at moderate temperatures for short periods of time to achieve near or full T6 temper properties. However, there are drawbacks to using an unstable T4 temper material in stamping operations inasmuch as the T4 temper is long-term unstable. Due to its instability, if a T4 temper material is used to make a component (through a forming process) the drawn/stamped region can develop cracks during the forming operation.

Prior methods for overcoming the disadvantages of T4 temper alloys includes utilizing T5 or T6 temper alloys. T4 temper products are solution heat treated and naturally aged. T5

temper products cooled from an elevated temperature and artificial aged. T6 temper products are solution heat treated and artificially aged.

Although a T5 or T6 temper aluminum alloy is stable, it is difficult to draw or stamp such a material. Indeed, the material is generally too brittle to permit forming through such processes. U.S. Patent No. 5, 911, 844 to Benedyk, as referenced by the Examiner, heat treats T5 or T6 alloys to make them suitable for forming and is not directed to processing of T4 alloys or alleviating the difficulties of instability in T4 alloys.

In one embodiment, Applicants' have discovered that the instability effects resulting in cracking of splines formed in tubes of T4 alloys may be overcome by a method that includes the steps of providing a metallic tube comprised of an aluminum alloy selected from the group consisting of 2000, 5000, 6000, or 7000 series and having properties approaching or corresponding to T4 temper; heating said metallic tube to a temperature sufficient to remove the T4 temper; quenching said metallic tube; forming splines on said metallic tube; and artificially or naturally aging said metallic tube, as recited in Claim 1.

Turning now to the Office Action, the Examiner rejected Claims 1, and 4-2, under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the enablement requirement. Claims 1-6, 8-10, 12-18, and 21 stand rejected, under 35 U.S.C. §103(a), as being allegedly unpatentable over U.S. Patent No. 5,911,844 to Benedyk ("Benedyk"). Claims 7, 19, 20, and 22 stand rejected, under 35 U.S.C. §103(a), as being allegedly unpatentable over Benedyk in view of the publication ASM: Aluminum and Aluminum Alloys P. 305, 311, 319, and 462-463 ("ASM"). Claim 11 stands rejected under 35 U.S.C. §103 (a) as allegedly being unpatentable over Benedyk in view of U.S. Patent No. 6,452, 139 to Benoit et al. ("Benoit et al.").

Referring first the rejections under 35 U.S.C. §112, first paragraph, it is the Examiner's position that the claims allegedly contain subject matter, which was not described in such a way as to enable one skilled in the art to practice the invention. In response to the Examiner's comments and for the purposes of advancing prosecution, Applicants have amended Claim 1 to recite that the metallic tube is formed of an aluminum alloy composed of 2000, 5000, 6000, or 7000 series aluminum. Support for the amendments to Claim 1 is found in original dependent Claim 2. In light of the amendments to incorporate the subject matter of Claim 2 into their respective base claims, Applicants have cancelled Claim 2. Applicants have also amended Claim 3 to correspond with amended Claims 1. In light of the above described amendments, Applicants submit that the present §112, first paragraph, rejection has been overcome and respectfully request withdrawal thereof.

Turning to the rejections under 35 U.S.C. §103, to establish a prima facie case of obviousness three criteria must be met. First there must be some suggestion or motivation, either in the references themselves or the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1543, 1457-58 (Fed. Cir. 1998). Second, there must be a reasonable expectation of success. *In re Merck & Co, Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Finally, the prior art reference (or references) combined must teach or suggest all of the claimed limitations. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Applicants submit that the applied references fail to render Applicants' claimed invention unpatentable, since none of the applied prior art, either alone or in combination, teach or suggest a method of forming splines on a metallic tube comprised of an aluminum alloy selected from the group consisting of 2000, 5000, 6000, or 7000 series and having properties approaching or

corresponding to T4 temper. "To establish a *prima facie* case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art". *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970).

Referring to the §103 rejection of Claims 1-22, Benedyk disclose a method for forming a metallic article having T5 or T6 temper. More specifically, Benedyk discloses a method for increasing formability for drawing or stamping of hardened materials of T5 or T6 temper, which as discussed above, and as disclosed in column 1, lines 50-55 of the Benedyk reference, is typically too brittle to subject to draw and stamping operations. Benedyk disclose subjecting the T5 or T6 material to a temperature that softens the materials temper, hence removing the effects of the materials T5 or T6 heat treatment. Benedyk does not disclose T4 temper or methods for treating T4 temper materials to increase their stability. Therefore, Benedyk fails to render Applicants' invention unpatentable, since Benedyk does not disclose a method for forming splines on a metallic tube comprised of an aluminum alloy selected from the group consisting of 2000, 5000, 6000, or 7000 series and having properties approaching or corresponding to T4 temper, as recited by Applicants' amended Claim 1.

Turning to page 3 of the Office Action, the Examiner notes that Benedyk does not teach or suggest T4 type temper, but starts with stronger harder tempers of T5 or T6. The Examiner further alleges that it would have been obvious for one of ordinary skill in the art to apply the process of retrogressive heat treating as disclosed in Benedyk to a T4 temper aluminum alloy, because Benedyk allegedly teaches a process the greatly improves formability in T5 or T6 temper materials. Applicants respectfully disagree and submit the following:

To reiterate, alloys in T5 and T6 tempers have limited suitability for forming and stamping due to their higher hardness than alloys in T4 temper alloys. Hardness and ductility

are substantially inversely proportional. T4 temper alloy shave suitable ductility for forming and stamping operation, but are unstable, wherein their instability may lead to cracking. Therefore, since Benedyk discloses a method for reducing hardness and increasing ductility, and hence formability, in T5 or T6 temper alloys, one having ordinary skill in the art would not find the process disclosed in Benedyk suitable for T4 alloys, because it is an attribute of T4 alloys to have a ductility that is suitable for forming and stamping operations without further processing. Contrary to the Benedyk, Applicants' process reduces long term instability in T4 temper alloys.

It is further noted that Applicants' claimed method requires (1) forming a metal tube having properties approaching or corresponding to T4 temper; (2) heating the metallic tube to a temperature sufficient to remove the T4 temper; (3) quenching the metallic tube; (4) forming splines on said metallic tube; and (5) artificially or naturally aging said metallic tube. Benedyk does not disclose forming splines on a previously formed tube, but instead discloses (1) heat treating a T5 or T6 temper material to a softened condition, (2) forming the material, and (3) heat treating the formed material to a strength and hardness at least equal to T5 or T6 temper. Therefore, Benedyk does not disclose forming splines on a previously formed (e.g. extruded or stamped) metallic tube, as required by amended Claim 1.

Therefore, since Benedyk is directed to T5 and T6 temper alloys, and further fails to disclose T4 tempers or methods for overcoming long term instability in T4 tempers, or discloses further forming of a previously extruded or stamped product, Benedyk fails to teach or suggest each and every limitation of Applicants' claimed method. Applicants respectfully submit that the §103 rejections of Claims 1-22 have been obviated and respectfully request withdrawal thereof.

Claims 7, 19, 20 and 22, stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Benedyk in view of pages 305, 311, 319 of the ASM. Benedyk fails to render

Claims 7, 19, 20 and 22, for the same reason Benedyk fails to render Claim 1 unpatentable. More specifically, Benedyk fails to teach or suggest a method for forming splines on a metallic tube, comprising the steps of providing a metallic tube comprised of an aluminum alloy selected from the group consisting of 2000, 5000, 6000, or 7000 series and having properties approaching or corresponding to T4 temper, as recited in amended Claim 1. If an independent claim is non-obvious under 35 U.S.C. §103(a), then any claim depending therefrom is non-obvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

The ASM fails to fulfill the deficiencies of the primary reference, since the ASM also fails to teach or suggest a method of forming splines on a metallic tube including the step of providing a metallic tube comprised of an aluminum alloy selected from the group consisting of 2000, 6000, or 7000 series and having properties approaching or corresponding to T4 temper, as recited in amended Claim 1. Applicants submit that the ASM publication is far removed from Applicants method. Page 305 of the ASM discloses forming and straightening following quenching processes, Page 311 of the ASM discloses precipitate hardening, and Page 319 discloses annealing, wherein none of the cited passages of the ASM disclose a method of forming splines on a metallic tube including the step of providing a metallic tube comprised of an aluminum alloy selected from the group consisting of 2000, 6000, or 7000 series and having properties approaching or corresponding to T4 temper, as recited in amended Claim 1. Therefore, since the combination of Benedyk and the ASM fail to teach or suggest each and every limitation of Applicants' claimed method, it is respectfully requested that the present §103 rejection citing Benedyk and the ASM be withdrawn.

Benoit et al. also fail to fulfill the deficiencies of Benedyk, since Benoit also fails to teach or suggest a method of forming splines on a metallic tube including the step of providing a

metallic tube comprised of an aluminum alloy selected from the group consisting of 2000, 6000, or 7000 series and having properties approaching or corresponding to T4 temper, as recited in amended Claim 1. Benoit et al. disclose a process for joining high strength metal components by electromagnetic forming techniques and is far removed from the Applicants' invention. Applicants note that the Examiner is relying on the Benoit et al. reference solely to meet the limitation of rotating the metallic tube during heat treatment. There is no disclosure of Applicants' claimed method of forming splines on a metallic tube throughout the Benoit et al. reference. Therefore, since the combination of Benedyk and the Benoit et al. fail to teach or suggest each and every limitation of Applicants' claimed method, it is respectfully requested that the present §103 rejection citing Benoit et al. and the ASM be withdrawn.

Accordingly, the Examiner is respectfully requested to reconsider the application, withdraw the rejections and issue an immediate a favorable action thereon. If upon review of the application, the Examiner is unable issue an immediate Notice of Allowance, the Examiner is

respectfully requested to telephone the undersigned attorney with a view towards resolving any outstanding issues.

An early and favorable action is earnestly solicited.

Respectfully submitted,



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